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IS 5518 (1996): Steels for die blocks for drop forging [MTD 16: Alloy Steels and Forgings]

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पात गढ़ाईयों के डाई ब्लाक के लिये इस्पात – विशिष्टि

(दूसरा पुनरीक्षण)

Indian Standard

STEELS FOR DIE BLOCKS FOR DROP FORGING — SPECIFICATION

(Second Revision)

ICS 77.140.80

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

August 1996

Price Group 2

Alloy Steels and Special Steels Sectional Committee, MTD 16

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Alloy Steels and Special Steels Sectional Committee, had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1966 and was revised in 1979. As a result of the experience gained in the production and use of steels, it has been decided to undertake its revision.

The major modifications made in this revision are:

a) References to relevant IS standards have been incorporated in clause **2**.

b) Two new grades T55 Ni 7Cr 4Mo5V1 and T55Ni7Cr3Mo3V1 being widely used in the country (equivalent to DIN 1.271 3 and 1.271 4) have been included under various clauses.

This standard contains clauses **5.1**, **5.3**, **7.1**, **9.2.1**, **11.1**, **13.1**, **14.1** and **15.1** which call for agreement between the purchaser and the manufacturer.

An informative Annex A has been included for the benefit of the purchaser giving particulars to be specified by the purchaser while placing order for the steels covered in this standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STEELS FOR DIE BLOCKS FOR DROP FORGING — SPECIFICATION

(Second Revision)

1 SCOPE

This standard covers the requirements for steels for die blocks in square, rectangular and circular sections for drop forging.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
228	Methods of chemical analysis of steel *(various parts)*
1762 (Part 1) : 1974	Code for designation of steels : Part 1 Based on letter symbols *(first revision)*
1500 : 1983	Brinell hardness test for metallic materials
1956 : 1976	Glossary of terms relating to steels : Parts 1 to 8
3664 : 1991	Code of practice for ultrasonic pulse echo testing by contact and immersion method
3711 : 1966	Selection and preparation of samples and test pieces for mechanical tests for wrought steels
8910 : 1978	General technical delivery requirements for steels and steel product
10138	Macroscopic methods for determination of nonmetallic inclusion in wrought steels
(Part 1) : 1992	Blue fracture test method *(first revision)*
(Part 2) : 1983	Step machined test method
(Part 3) : 1983	Magnetic particle inspection method
11371 : 1985	Method for macrotech test for wrought steel products
12211 : 1987	Micrographic method for assessing the distribution of carbides in tool steel and bearing steels using photomicrographs

3 TERMINOLOGY

For the purpose of this standard, the definitions given in revelant parts of IS 1956 shall apply.

4 SUPPLY OF MATERIAL

4.1 General requirements relaing to the supply of material shall conform to IS 8910 : 1978.

4.2 Steels covered in this standard shall be ordered and delivered on the basis of :

a) Chemical analysis, or

b) Chemical analysis and the hardness in annealed condition, or

c) Chemical analysis and the hardness in hardened and tempered condition.

5 MANUFACTURE

5.1 Unless agreed to in the order, the processes used in making the steel and the products are left to the discretion of the manufacturer, but the steels shall be fully killed. When so desired, the purchaser shall be informed of the steel making process.

However, for continuously cast steels and for steels in specially treated condition, like secondary refined, vacuum degassed. Electroslag or elector-flux refined, etc, the steel making process shall be agreed to at the time of enquiry and order. For continuously cast materials, the reduction ratio between the cast product and the final product shall be agreed to at the time of ordering.

5.2 Sufficient reductions and discards shall be made from each ingot to ensure freedom from piping, harmful segregation and other harmful defects.

5.3 Unless otherwise agreed to between the purchaser and the manufacturer, the method of forging circular die blocks is left to the discretion of the manufacturer.

5.4 The material shall be properly conditioned during the process of manufacture to remove any surface impression likely to produce defects in the finished products. The depth of conditioning shall be within machining allowance and the width of conditioning shall be at least four times its greater depth.

6 FREEDOM FROM DEFECTS

The material shall be free from internal defects like pipe and flakes. It shall be free from harmful surface defects like seams, laps and cracks beyond the machining tolerance.

7 CHEMICAL COMPOSITION

7.1 The ladle analysis of steel shall be as given in Table 1. The analysis shall be carried out by IS 228 and its relevant parts or any other established instrumental/chemical method. In case of any dispute, the procedure given in IS 228 and its relevant parts shall be the referee method. However where the method is not given in IS 228 and its relevant parts,

Table 1 Chemical Composition of Steels for Die Blocks

(*Clauses* 7.1 *to* 7.3 *and* 11.1)

Steel Designation IS 1762 (Part 1) : 1974	Chemical Composition, Percent								
	C	Si	Mn	Ni	Cr	Mo	V	S *Max*	P *Max*
60T6	0.55-0.65	0.10-0.35	0.50-0.80	-	-	-	-	0.035	0.035
T6ONi5	0.55-0.65	0.10-0.35	0.50-0.80	1.0-1.4	-	-	-	0.035	0.035
T55Ni6Cr3	0.50-0.60	0.10-0.35	0.50-0.80	1.25-1.65	0.50-0.80	-	-	0.035	0.035
T50NiCrMo4	0.48-0.53	0.10.0.35	0.50-0.80	0.80-1.00	0.80-1.00	0.30-0.40	-	0.035	0.035
T55Ni6Cr3Mo3	0.50-0.60	0.10-0.35	0.50-0.80	1.25-1.75	0.50-0.80	0.25-0.35	-	0.035	0.035
T55Ni7Cr4Mo5VI	0.50-0.60	0.10-0.35	0.60-0.90	1.50-1.80	1.00-1.20	0.45-0.55	0.07 to 0.12	0.035	0.035
T55Ni7Cr3Mo3VI	0.50-0.60	0.10-0.35	0.60-0.90	1.50-1.80	0.60-0.80	0.25-0.80	0.07 to 0.12	0.035	0.035

the referee method shall be as agreed to between the purchaser and the manufacturer.

7.2 Unless otherwise agreed, elements wherever not quoted in Table 1 shall not be added to the steel except for the purpose of finishing the heat and shall not exceed the following limits:

Element	*Percent, Max*
Chromium	0.25
Molybdenum	0.25
Nickel	0.25
Copper	0.35
Tin	0.05
Cobalt	0.10
Vanadium	0.05
Tungsten	0.25

7.3 Check Analysis

Wherever specified, check analysis shall be carried out on the finished product. The permissible variation of the check analysis for the limits of ladle analysis given in Table 1 shall be as given in Table 2.

Table 2 Permissible Variation in Check Analysis

Element (1)	Permisible Contents in Ladle Analysis (Percent) (2)	Permissible Variation of Product Analysis (Percent) (3)
C	0.48 to 0.65	± 0.03
Si	0.10 to 0.35	± 0.03
Mn	0.50 to 0.90	± 0.04
Ni	0.80 to 0.80	± 0.05
Cr	0.50 to 1.20	± 0.05
Mo	0.25 to 0.55	± 0.04
V	0.07 to 0.12	± 0.02
P	< 0.035	± 0.005
S	< 0.035	± 0.005

NOTE — The deviations, other than when maximum only are specified, apply either above or below the specified limits of the range, but not both above or below for the same element from different sample products from the same cast. When maxima only are specified, the deviations are positive only. The values are valid only if the samples are selected in accordance with IS 3711 : 1966, so that they represent the average composition of the cross section of the product.

8 HEAT TREATMENT

Steel shall be supplied in annealed or in hardened and tempered condition, as specified in the order.

9 HARDNESS

9.1 Steels in the annealed condition, when tested in accordance with IS 1500 : 1983 shall have the brinell hardness as given below:

Steel Designation	*Brinell Hardness, HB, Max*
60T6	220
T60Ni5	220
T55Ni6Cr3	255
T50NiCrMo4	255
T55Ni6Cr3Mo3	255
T55Ni7Cr4Mo5V1	255
T55Ni7Cr3Mo3V1	255

9.2 Steels, when ordered in the hardened and tempered condition, shall have the following hardness range:

Steel Designation	*Brinell Hardness, HB, Max*
60T6	212-269
T60Ni5	212-269
T55Ni6Cr3	235-302
T50NiCrMo4	269-477
T55Ni6Cr3Mo3	269-477
T55Ni7Cr4Mo5V1	269-477
T55Ni7Cr3Mo3V1	269-477

9.2.1 When ordered in hardened and tempered condition, steels T55Ni7CrMo3V1, and T55Ni7Cr4 Mo5V1 shall be supplied to any one of the following tempers as specified in the order, unless otherwise agreed to between the purchaser and the supplier:

Temper	*Brinell Hardness, Range, HB*
A	444-477
B	388-429
C	341-375
D	302-331
E	269-295

NOTE — Other hardness test methods may be used by agreement between manufacturer and purchaser.

10 SAMPLING

10.1 Sampling for Chemical Analysis

The ladle analysis shall be supplied by the manufacturer. If the product analysis is required by the purchaser at least one sample product shall be taken from each cast.

10.2 Sampling for Hardness

If supplied in bar form, one sample shall be taken from each heat treatment batch for the determination of Brinell hardness. If supplied as die blocks, each block shall be tested for Brinell hardness on the impression face.

11 RETEST

11.1 Retest for Product Analysis

If the results of the product analysis do not meet the composition requirements given in Table 1, unless otherwise agreed to between the purchaser and the manufacturer, two new samples shall be taken from different pieces of the same cast. Should the analysis of the two samples satisfy the requirements, the lot represented shall be accepted. Should either of the test fail, the material shall be taken as not complying with this standard.

11.2 Retest for Hardness

If the sample selected under **10.2** fails to meet the hardness requirement of this standard, two new samples shall be taken from different pieces of the same heat-treatment batch. Should the hardness of the two samples satisfy the requirements, the consignment shall be accepted. Should either of the two samples fail, the manufacturer shall have the right, if he so desires, to reheat-treat the product in any suitable manner before fresh samples are taken for retesting. The manufacturer may reheat-treat not more than thrice for retesting without approval of the purchaser. If the material fails to exhibit the required hardness after heat treatment for the third time, it shall be considered as not complying with this standard, unless further heat treatment is approved by the purchaser.

12 DIMENSIONAL TOLERANCES

12.1 The following tolerances shall apply for die blocks:

Size mm	*Tolerance* mm
Up to 375	+ 8 − 0
Over 375	+ 15 − 0

13 MACHINING ALLOWANCE

13.1 The machining allowance shall be as agreed to between the purchaser and the manufacturer.

14 ULTRASONIC TEST

14.1 Each bar of size 100 mm and above or each die blocks shall be ultrasonically tested in accordance with IS 3664 : 1981 for internal soundness, the acceptance standard for which shall be mutually agreed to between the purchaser and the manufacturer at the time of order.

15 ADDITIONAL TESTS

15.1 If agreed to between the purchaser at the time of enquiry and order, any or a combination of the following tests may also be carried out to ensure that the steels meet the quality requirements of the purchaser:

a) Macro etch test in accordance with IS 11371 : 1985;
b) Cleanliness test as per IS 10138 (Part 1) : 1992, IS 10138 (Part 2) : 1983 and IS 10138 (Part 3) : 1983; and
c) Distribution of carbides as per IS 12211 : 1987.

16 MARKING

16.1 Each bar above 50 mm diameter or equivalent cross section or each die block shall be suitably marked with the following:

a) Name or trade-mark of the manufacturer; and
b) Cast number or any other identification mark by which the cast number and grade can be traced.

16.2 BIS Certification Marking

The material may also be marked with the Standard Mark.

16.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Foreword*)

BASIS FOR ORDER

While placing an order for the steels covered by this standard, the purchaser should clearly specify the following:

a) Grade of steel
b) Shape and size
c) Condition of delivery
d) Tests required
e) Special requirements, such as bundling and packing
f) Method of manufacturers
g) Test reports, if required

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This Indian Standard has been developed from Doc No. : MTD 16 (3669).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at Printograph, New Delhi (INDIA).